

ONENTS, AND NICOTINE

condensable material and into non-condensable material that can be filtered. It assumes the color we have used when gas-phase material which is

sol-phase material which can be used for testing in the laboratory. Smoke are present in the tar. The tar is by far the major constituents of cigarettes and within each cigarette used, the type and amount of tar of the final product at the time of use also modify the tar content. It is a source of specific information as to components to altered morbidity and mortality. A large body of information on

tar and gases including CO, HCN, and other more volatile agents including benzene in the tars. The latter component is usually by adsorption on particles. Tar captures gases only to a limited degree. It attracts considerable attention, although it is not a carcinogenic hazard. It acts as a collection point for the movement of mucus up the trachea and prolongs periods. The tar is a by-product in the tar and nicotine agents can be achieved by the use of a versus tar phase.

It is usually ascribed to nicotine as the most abundant, it is important to note that it is present in cigarettes. The other components of cigarettes and the relation to nicotine and the tar content results in both a relative and absolute, the nonnicotine alkaloids to the tar. Alkaloids in tars are manifest on the basis of carcinogenic effects of the tar. Mechanisms and the basic biologic action are still unknown.

They have been used in the laboratory to study smoke condensate and gaseous compounds in cancer causation, mutation, cell growth and flow; cell toxicity, alteration of the cell to act as a selective system, effect on clotting, congenital malformation, and fetal development of cigarette smoke components.

I emphasize that my listing of these does not indicate we have evidence of hazards in each of these.

"TAR"/NICOTINE AS INDICATORS OF HAZARD

Three complementary sources of data support the use of tar-nicotine as measures of hazard. Epidemiological studies in man have demonstrated a correlation between enhanced risk to adverse effects and exposure to tar-nicotine as determined by duration and intensity of smoking.

In other words, I think it is fair to equate smoking and exposure to tar and nicotine as a relative unit. There are other things in cigarette smoke beyond tar and nicotine of course but this is an effective, reliable method of measuring major components of interest to us today.

It is of interest that recent epidemiological studies have also shown that cessation of smoking is associated with reduction in risk to lung cancer. Analytical studies have identified and quantitated the presence of toxic and carcinogenic agents in tar. They are there. Bioassay studies in isolated tissue and intact animals have demonstrated cytotoxic and carcinogenic properties in a variety of model systems.

EFFECTIVENESS OF FILTRATION

All the carcinogenic materials that have been identified in tobacco smoke and which have been tested in the laboratory are present in the condensate and therefore are tar components. There is currently little evidence of preferential or selective reduction of any individual constituent by means of devices now used for tar reduction. It may be assumed that filtration results essentially in a reduction in each of the carcinogenic components in the same proportion.

I would emphasize the method of filtration, the pods indeed do have the remarkable capability of reducing tars, but they don't do that in other than an across-the-board manner more or less. They don't pick out individual items on the basis of chemical affinity, physical affinity, or the like.

It is hoped that future developments may achieve selective removal as some of the proposed techniques hopefully may reduce specific components of the tar. Ultimately, the use of the term "tar" as these selective filters become available, if they do, will become meaningless and will have to be replaced by chemically identifiable groups of compounds or individual components. The nicotine content is a useful example of a specific entity designation. It can be varied independent of tar concentration through the use of a variety of techniques.

OTHER ENVIRONMENTAL FACTORS

The effect of environmental factors other than cigarette smoke associated with an increased risk to lung cancer has been the subject of numerous studies. Of major interest has been the contribution of air pollution which at present appears to play a lesser role in the etiology of lung cancer, although its future significance is a matter

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ment which have standard setting, monitoring, regulatory responsibility. We provide information on which to make these judgments as wisely and as soundly as possible.

The CHAIRMAN. All right.

You have other matters under study down there other than the tobacco or cigarette problem?

Dr. KOTIN. We most certainly do.

The CHAIRMAN. All fields of environmental health.

Dr. KOTIN. Correct.

The CHAIRMAN. All right.

Now you have a statement, we will be glad to hear from you.

Senator COTTON. Before he starts, Mr. Chairman, I always find myself a little intimidated by the glare of these lights and all of this publicity. I am a pipe smoker, and this is going to be a long hearing.

Is it going to prejudice anybody if I smoke my pipe?

Dr. KOTIN. I trust it won't prejudice anybody any more than my smoking my pipe will.

The CHAIRMAN. This is all right, too.

Doctor, we will be glad to hear from you.

Dr. KOTIN. Thank you.

Mr. Chairman, I am pleased to appear before the Consumer Subcommittee of the Senate Committee on Commerce which is concerning itself with the progress being made toward the development and marketing of a less hazardous cigarette. While cessation of smoking offers the prime safeguard against the health risks associated with smoking, the subject of this hearing recognizes the importance of ancillary methods of consumer protection.

Reduction in the risks associated with cigarette smoking conceivably may be accomplished by one or more approaches within the framework of continued cigarette smoking. The following are some of the major factors that merit consideration in any long-range solutions to the problem:

✓ 1. The current and potential technological feasibility of reducing or removing those agents suspected of having carcinogenic cancer-causing, or otherwise adverse health effects;

2. The effect of the removal of these agents on consumer acceptance of the finished product. Consumer rejection of an unacceptable cigarette will inevitably result in the continued usage of the more satisfying though more hazardous product; and

3. Utilization of current knowledge to inform smokers of habits or techniques of smoking which may minimize the hazards of smoking.

This report will concern itself primarily with efforts toward reducing the hazard associated with cigarette smoking through product modification and methods of smoking. It is our belief that a less-hazardous cigarette is within the limits of accomplishment. While it may be argued that at present we are not assuredly aware of all of the carcinogenic agents, cocarcinogenic agents, or irritants

in cigarette smoke, tion are available ledge of constituent many classes of con the carcinogenic an constituents include oyclic types, phen agents, inorganic materials.

As assessment of their presence in ci markable degree ar future is being studi

It must be emph ual compounds with unknown although dertaken. Further, ogenic agents as w is unreasonable to ous materials in cig ive goal. Rather, co tative and quantit achieve maximum r

In the general ar that a relationship and the response as r laboratory, or by ris miological studies. also been demonstra man and for smoke perimental lab mod have clearly shown smoked and the dur velopment of lung smoke condensate have been shown to cinogenic models. extent of exposure perimental animal, in the laboratory: Efforts directed to cigarette smoking less-hazardous cig habits; and (2) at smoker, so as to pr carcinogenic const major approaches, elaboration.

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for serious concern. Smoking urban populations are at greater risk than their rural counterparts, most particularly in the United Kingdom where the overall incidence of lung cancer is higher than in the United States. Air pollution is undoubtedly a contributing cause to this disparity.

We in the United States may just be embarking on a period of increased hazard from air pollution, and unless effective control measures are developed, its role can only increase in importance.

I trust I will be forgiven for making this plug for air pollution control.

Occupational factors have also been shown to contribute to lung cancer causation. Industrial exposure to chromium and nickel refining and processing, asbestos, coking operations, and radioactive ore mining are some examples of occupations with abnormal lung cancer risks. For virtually all such exposures the simultaneous exposure to cigarette smoke enhances the preexisting increased risk. One may question whether any level of smoking is nonhazardous for those occupationally exposed to increased lung cancer risks.

A LESS HAZARDOUS CIGARETTE

✓ It is now technically possible to remove or reduce certain constituents of cigarette smoke which have been incriminated as being responsible in part for the carcinogenic and other hazardous properties of cigarette smoke. For other constituents, techniques have yet to be developed. Known variations in the chemical properties of the tobacco leaf, itself, also offer an opportunity to exploit differences all to the ultimate end of reducing total smoke condensate as well as individual hazardous components. The technical approaches include (a) reduction of total smoke condensate, or tars, (b) reduction of carcinogens in smoke, or in the tars, (c) reduction of cocarcinogens in smoke. These are factors which enhance or increase the efficiency of cancer-producing chemicals and their biological effects.

Included in our approach would be the reduction of irritants—which interfere with mucociliary function—and we might consider adding some materials which would buffer or protect the cells.

Paralleling attempts to develop a less hazardous cigarette, efforts should be directed to a less hazardous smoking pattern. Butt length is one of the major factors which determines the quantity of smoke constituents delivered to the lungs of the smoker. As butt length decreases below a certain point, a disproportionately large amount of tar is contained in the smoke due to the delivery of previously trapped and filtered material in the cigarette tobacco itself. By this I mean the cigarette tobacco itself acts as a filter proximal to the burning end.

Studies are needed to determine precisely the butt length at which this increased dose zone appears; and to dramatically inform the smoker of this important fact, we would recommend the introduction of a line—red or black—on each cigarette indicating the butt length that correlates with a given amount of tar or nicotine.

This butt length indicator would also serve as a monitoring device for the smoker to let him know he is getting close to the "danger line."

Now there are other aspects very briefly and that is t

HOST MODIFICATION

It is universally recognized that the environment are not at all generalization applies to lung cancer as well. Even death and other ancillary number of smokers, particularly dose range, for example, 20 years, do not develop ca

While we are unaware of susceptibility or resistance to exists for the modifying genetic agents are metabolized in a manner to other environmental entry. This applies to an agent in cigarettes.

Metabolism is accomplished in individuals may vary in and these are enzymes modified. And individuals can vary in enzymes that can convert to state, as part of the host's this problem should be in metabolic characteristics. It may be possible to determine the metabolic profile of individuals by identifying some "susceptible" individuals. This has been done admirably in the case of measles. If we had measles, we can measure, so we can measure on the basis of

Now I mentioned that irritants which affect the ciliary action and physical properties affecting ciliary action. A partial paralysis of the bronchi permits the accumulation of mucus in the bronchi so that a prolonged retention of mucus can enter the target respiratory tract.

It has been shown that the rate of metabolism is significantly controlled by mental animals it has been shown that the accumulation of products is prevented through the agents.

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